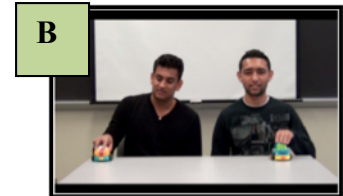


Giving sentence interpretations a *push* in the right direction

What do you expect when you hear *Two boys pushed a car*? Are two boys pushing the same car as in scene A, or are the two boys pushing their own respective car at the same time as in scene B? In work we began last year,



we found that both children three- to four- years of age and undergraduates accepted the first sentence in both scenes. We showed them a series of short videos of people doing activities like this. However, while the ‘adults’ preferred A, children preferred scene B. This is interesting, because it shows us that children – like adults – have linguistic representations that allow them to access two different interpretations for these ambiguous sentences. However, they are not yet fully adultlike, since their preferences differ. We are currently investigating *why*.

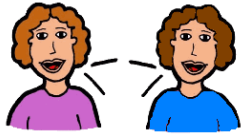
What about when you hear a slightly different sentence: *Two boys pushed a car together*? Can this sentence be true in both scenes? We have found that adults are strongly drawn towards only accepting this sentence in A, while children continued to accept the sentences in both scenes. We know children weren’t just blindly accepting the sentences, because they provided us with such beautiful justifications for their responses, and also eagerly rejected other sentences when they were clearly wrong. When we asked children for their *preference* of A or B with the sentence with *together*, this time they sided with adults, preferring A for this sentence. This gave us even more reason to think that children might have had a reason for accepting this sentence in scene B.

So why do children differ in their treatment of the *together* sentence? If you think about it, *together* actually has multiple interpretations! People can work together, sit down together, lift a heavy object together, and so on. Under some of these interpretations, the activity is ‘collective’ and has a sense of collaboration. (as in A). The adults apparently tune in to this meaning. However, in other interpretations, there are multiple activities done at the same time or in the same location (as in B).

We wanted to see if children were accepting the sentence in B for this reason, so we targeted the elements of space and time. The goal was to determine whether children were being guided by their semantics. In fact, when we had the boys push their cars at different times, children began to reject the sentences with *together*—especially when they interacted with a puppet, whose statements they knew they could comfortably correct. If he was right, he got a cookie. If he was wrong he drank milk. Children loved this game, and really wanted to help the rabbit learn!



We also wanted to see if we could get adults to start accepting the sentence in B. If they could, then this would be additional evidence that children were doing something adult-like by accepting these sentences in B. In order to do so, we increased the social interaction of the people in the scene. The boys walked in talking, showed each other their cars, and coordinated their pushing. As a result, adults were more likely to accept the sentences! We are currently investigating the range of contexts in which adults will allow similar sentences with and without *together* to be true – and how they make these decisions in real time, by evaluating their reaction time in milliseconds.



Speaking CLEARLY

We know that adults can change the way they speak to make their message understood better. They recruit this strategy when they are speaking to a non-native speaker of their language, when they are speaking in a noisy environment, and when they are talking to children. We were very interested in knowing how early this ability develops. One might think (as people did for many years) that children are egocentric and will speak the same way regardless of their conversation partner, since they are unaware of this other person's needs. One might think, however, that children are much smarter than this, and not only know that they need to alter their speech, but know just how to do it. Last year, we recorded children repeating words after one of us in two different contexts. In the first, they just repeated the words. In the second, they labeled pictures using 'clear speech.' We found consistent differences in the way they said words such as *cat*, *sheep*, and *nose*: when they were asked to speak clearly, they made the word longer and louder.



But how much were they just following the adult's lead? Were they simply imitating the adult pronunciation of these words in the 'normal' and 'clear' contexts? We didn't think so, based on what we were seeing and hearing in our studies, but we wanted to be sure. This year, we changed the task slightly so that children first labeled pictures of objects, then taught a puppet these same words. The puppet tried to repeat these words. Sometimes the puppet would mispronounce the word, so the children were easily encouraged to speak clearly. We are currently analyzing these productions, but our initial impression working with the children was that they were making a clear distinction between words that they used as object labels for themselves, and words that were object labels for another individual learning them for the first time.

Measuring Number Understanding

We know that when children use number words, they are most likely using them to count things—people, toys, cars, crackers, and so on. But number words are not only used for counting out discrete things. We can also use them to measure out amounts, and use expressions like *2 pounds of cheese*, *4 feet tall*, *7-pound baby*, and *12-grain bread*. Children hear these expressions, but what do they know about them? In a series of experiments over the last



few years, we have been investigating what four-year-olds (children who can count very well) know about these expressions of measurement. In one scenario, we present a choice between strawberries that are described as huge, each weighing 3 pounds, and strawberries that are small and weigh 3 pounds all together. We should the children a character considering purchasing both, and in the end choosing the smaller strawberries. When a puppet says that the character bought the *3-pound strawberries*, children generally reject this statement, and correct the puppet saying that the character did not buy the big strawberries!

In previous studies, we showed that children make a distinction between *3-pound strawberries* and *3 pounds of strawberries*. We showed the children a picture of some strawberries and referred them in one of these two ways. We then had a mouse come and nibble some strawberries up, and asked them if *3-pound strawberries* or *3 pounds of strawberries* remained. Children generally correctly answered ‘yes’ in the first case, and ‘no’ in the second. However, they appeared to want to count out the objects whenever possible, and this strategy sometimes led them astray. It seems that the ability to count, which they worked to hard to acquire those first four years, is something they have to also learn to suppress when they are learning about the full range of linguistic environments in which number words appear!

This brings us back to the first study we described. If I tell you that *Two boys pushed two cars*, you could accept that if both boys pushed two cars together, or if they each pushed their own two cars. The second scenario actually involves 4 cars, so ‘two’ doesn’t always mean ‘two’! Learning about number involves so much more than counting!

Try this at home!

Any time you are sitting down to a meal or a snack with your child, use this opportunity to see what they know about numbers and expressions of measurement!

- **Ask your child how to count out pretzel sticks, raisins, or berries.** Did your child recognize that the last number in the sequence tells you how many you have? Did she give each object its own number, or did she ‘double count’ or skip around? If she didn’t count the way you would have, don’t worry—this is very common! It’s fun to see the progression over the years until she knows how to count just like you!
- **Ask your child how much she thinks a grape weighs. What about a whole bunch of grapes? How much does she think she weighs?** Did she estimate in the right range, or were her estimates way off? Did she use expressions of measurement that were related to weight, or did they seem better fitted for height or age? If you noticed that her expressions of measurement weren’t the kind you would use, don’t worry! Children make charming errors in this area well into elementary school. It’s great to see how they begin to put the pieces together as they acquire more knowledge and get older!
- **Bring in some toy characters. Ask your child to use these to show you “Two monsters are eating a cracker” or “Two girls are holding three pretzels.”** Did she give each monster a cracker, or have them nibble the same one? Did each girl hold three strawberries, or did your child make each one hold the same three strawberries together? Did she do the same thing each time? Try different variations of this, and watch how your child thinks carefully about the meaning of what you are saying!

Did your child just want to have snack and not bother with the math? Don't worry! These opportunities to see what your child knows come up all the time—sometimes when you least expect it!